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BOOK REVIEWS

Queueing Systems, Volume II: Computer Applications. By LEONARD KLEINROCK. Wiley-Interscience, New York, 1976, xx + 549 pp.

This book is the second in Kleinrock's two-volume set, the first being *Queueing Systems, Volume I: Theory*, published in 1975. According to the dust jacket blurb, Volume II can be used both as a textbook in an applications course that follows a queueing theory course taught from Volume I and as a reference for professionals in the fields of information processing and computer systems analysis. As stated in the Preface, the book developed from graduate-level class notes prepared for courses taught in the Computer Science Department at UCLA. Its purpose "... is twofold: first, to modify the tools of queueing theory in a way that permits them to be applied to real-world problems; and second, to make an extensive application of these tools to various and important modern-day computer systems."

Chapter 1 (A Queueing Theory Primer, 26 pages) is a summary of the important results of queueing theory. This material, which is condensed from Volume I, is included in order that Volume II be self-contained. Although this chapter provides a useful reference, I doubt that a naive reader would find it alone sufficient to enable comprehension of the rather sophisticated applications of queueing theory that are described in some of the following chapters.

Chapter 2 (Bounds, Inequalities and Approximations, 79 pages) discusses methods for obtaining information about important models that do not readily yield to exact theoretical analysis. This material is not immediately concerned with computer applications, and arguably could have been included in Volume I.

Chapter 3 (Priority Queueing, 50 pages) discusses, among other things, conservation laws and the effects of various priority queue disciplines. Like Chapter 2, this chapter is not immediately concerned with applications, but rather develops the theory further toward the computer models of Chapter 4.

Chapter 4 (Computer Time-Sharing and Multiaccess Systems, 114 pages) is concerned largely with processor-sharing algorithms. This chapter is the high point of the book, being an authoritative account of some very interesting and important models. (Much of the work on which this chapter is based was done originally by Kleinrock himself.) It appears that some of the derivations given in this chapter are new and "intuitive"; this gives new insight, but in some cases (for example, the interesting discussion of the round-robin model on pp. 166–170) I found the mathematics confusing. However, since all the original references are listed, the reader can always consult them. Taken as a whole, this chapter is especially interesting and well done.

Chapter 5 (Computer–Communication Networks: Analysis and Design, 152 pages) discusses some of the general design principles that have evolved for networks of computers. Much of this discussion is in the context of ARPANET, an experimental computer network to whose design Kleinrock has contributed.

Chapter 6 (Computer–Communications Networks: Measurement, Flow Control, and ARPANET Traps, 94 pages) uses simulation and measurement experiments on ARPANET to explore the validity of the models and tools developed in the previous chapter. This chapter necessarily contains much technical information on ARPANET, making if tough going for the reader who is interested only in general principles.

Each chapter is followed by a list of references and a set of exercises. In addition, the book contains a Glossary of Notation (7 pages), a Summary of Important Results (13 pages), and an Index (13 pages).

Kleinrock writes in an informal style, conveying his obvious enthusiasm to the reader. His discussion emphasizes the meaning of the formulas he derives and the relationships, if any, with other results. Many graphs are included to illustrate the implications of the formulas.

A few cavils: although there is a subject index, there is no author index. To see whether a particular author or paper is cited, one must look through the list of references at the end of each chapter. Even if the sought-after reference is located in one of these lists, there is still no way to find where and in what context that particular reference is cited in the text. References are cited in the text by giving in brackets the first four letters of the senior author's name and the publication date, e.g. [KLEI 75] for the author's Volume I. This can be annoying, especially when the first four letters are not especially mnemonic (BORO for Borovkov), or when both the author's name and the first four letters are given ("as shown by Buzen in [BUZE 73]"). The book's utility as a text is lessened by the absence of answers for any of the exercises.

In summary, this is an important and authoritative book, reflecting the author's wide knowledge, experience, and enthusiasm, that will be especially useful to the professional or researcher concerned with mathematical modeling of operating systems and computer networks.

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Some Modern Mathematics for Physicists and Other Outsiders. By PAUL ROMAN. Pergamon Press, New York, 1975. Volume 1: 378 pp., $25.00; Volume 2: 335 pp., $25.00.

The rapid progress of Physics and Mathematics requires one to keep up to date with the theory and application. The work presented here will facilitate the process of gaining the necessary knowledge and perception of the following topics: Volume 1. Algebra, Topology and Measure Theory.

Part 1. Sets, operations with sets, equivalence and order relations, maps, composite functions, cardinal numbers.

Part 2A. Algebraic Structures, morphisms, group representations, conjugate classes, cosets, quotient groups. Rings and fields, ideals, quotient rings. Linear spaces, vector spaces, manifolds, quotient spaces. Linear algebras, structure constants, nonassociative algebras, Lie algebra.

Part 2B. Topological Structures, topological spaces, neighborhoods, convergence, continuity, homeomorphism. Connected spaces, separable, compact spaces, complete spaces.

Part 2C. Measure structures, measurable spaces, Lebesgue and Lebesgue–Stieltjes measures, signed and complex measures. Measurable functions, the integral and its properties, the Lebesgue and Lebesgue–Stieltjes integrals.

Volume 2. Combination of systems: Functional analysis and applications.

Part 3A. Topological linear spaces. Normed linear spaces, Banach spaces, Hilbert spaces, orthonormal sets, orthogonal complements and direct sums, weak convergence of vectors.

Part 3B. Mapping of topological linear spaces. Continuous linear transformations, linear functionals, dual spaces and the Riesz representation theorems. Linear operators: composition and inversion of operators, boundedness and structure of operators. Hilbert space operators and their properties. Hermitean, selfadjoint and normal operators, isometric, unitary and projection operators. Spectral theory and spectral representation of operators.

A brief review of generalized functions and distributions is presented in an appendix.

This work is well organized; the topics are selected with the guiding motive of covering both theory and applications. The material is well presented and explained, many diagrams, and a large selection of examples and problems contribute to a better understanding.

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